

# **SREF Heavy Precipitation Time Composite Situational Awareness Product (SAP)**

## **Product Description**

An experimental product derived from the National Centers for Environmental Prediction (NCEP) Short-Range Ensemble Forecast (SREF) system is being produced to help increase awareness of potential heavy precipitation events. The product is in the Keyhole Markup Language (KML) format which can be displayed in many different types of Geographic Information Systems (GIS) such as Google Earth.






The product displays a threat level indicating the potential for heavy precipitation at locations in the contiguous United States (CONUS) based on calibrated SREF Probabilistic Quantitative Precipitation Forecasts (PQPF) by an Artificial Neural Network (ANN). The ANN calibrated PQPFs are presented in the form of probability of exceedance (POE) forecasts. The probabilities to exceed .01, .25, .50, and 1.0 inch are provided for each 3-hour period for the 87 hours of the forecast cycle. Experimental probability thresholds are used to color code 4 threat categories of None, Low, Moderate, and High. These threat categories represent the potential for heavy precipitation at any time in the forecast period. The product format is intended to provide the user with a quick look at the potential threat for heavy precipitation during the next 87 hours at nearly 6,000 locations in the CONUS. Figure 1 shows the KML product in Google Earth. The red colored locations in this figure indicate a High threat for heavy rainfall across much of the southeast United States into parts of the Midwest from 03 UTC on April 30<sup>th</sup> 2010 to 18 UTC on May 3<sup>rd</sup> 2010. Figure 2 illustrates the outcome of this heavy precipitation event that claimed the lives of at least 27 people in Tennessee, Mississippi, and Kentucky.

The product also allows the user to examine the POE forecasts from the uncalibrated (or raw) SREF, ANN calibrated SREF, and the SREF mean QPF fitted to an exponential distribution. This forecast information is presented in the form of a table as shown in figure 3. A future enhancement to the product will give the user the ability to display a probability of exceedance chart for any 3-hour period similar to the chart shown in figure 4.

## **Technical Description**

The method used in this product to produce calibrated PQPF from the SREF utilizes an ANN technique. A separate ANN is developed for each of the 4 SREF model cycles (03Z, 09Z, 15Z, and 21Z), and for both cool (October 1<sup>st</sup> to March 31<sup>st</sup>) and warm (April 1<sup>st</sup> to September 30<sup>th</sup>) seasons. Observed precipitation from the Real-Time Mesoscale Analysis (RTMA) and fields from the SREF are used to train the ANN. The main fields from the SREF are the QPF and CAPE POEs and the ensemble mean precipitable water. The ANN is trained with 2 seasons of SREF and RTMA data. A method to continually update the ANN with recent events is planned.

The following experimental rules are used to determine the threat levels based on the output from the ANN:

| <b><u>Threat Level</u></b>  | <b><u>Criteria</u></b>  |
|---|---|
|  None      | QPF > 0.25 is less than 40% in any time period  |
|  Low       | QPF > 0.25 is greater than 40% in 2 to 3 time periods   |
|  Moderate  | QPF > 0.25 is greater than 40% in 4 to 6 time periods<br>or<br>QPF > 0.50 is greater than 20% in 2 to 4 time periods<br>or<br>QPF > 1.0 is greater than 10% in 1 to 2 time periods              |
|  High      | QPF > 0.25 is greater than 40% in more than 6 time periods<br>or<br>QPF > 0.50 is greater than 20% in more than 4 time periods<br>or<br>QPF > 1.0 is greater than 10% in 3 or more time periods |
|  No Precip | QPF > 0.01 is less than 15% in any time period  |

In addition to the ANN output, the product allows a user to select a location and display a table showing the uncalibrated SREF probabilities and probabilities derived from an exponential distribution using the SREF mean QPF. While the method to determine the uncalibrated SREF probabilities is straightforward, the exponential distribution fitting technique is not. A full description of this technique and its operational use at the Tulsa WFO can be found at: [http://ams.confex.com/ams/Annual2006/techprogram/paper\\_100354.htm](http://ams.confex.com/ams/Annual2006/techprogram/paper_100354.htm)

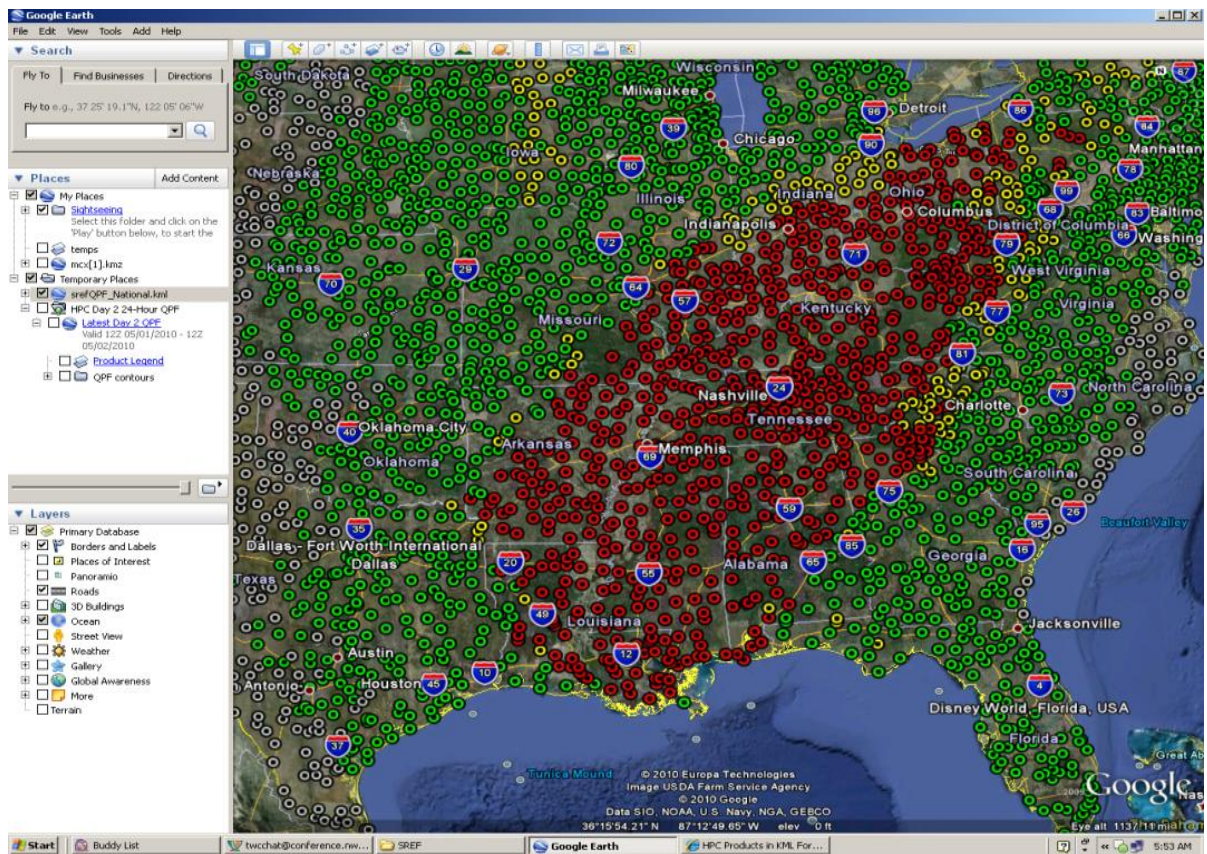


Figure 1. Google Earth display of SREF Heavy Precipitation SAP



Figure 2. CNN Headline Story

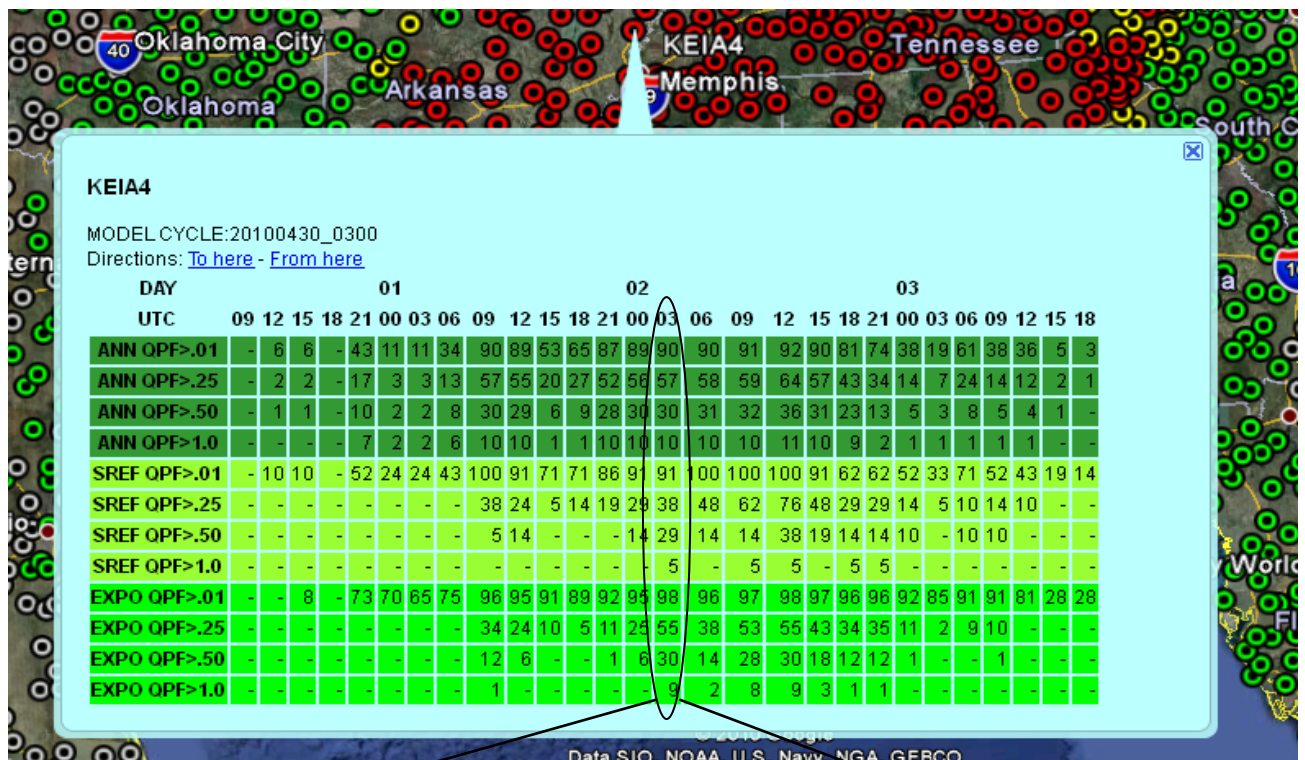


Figure 3. Heavy Precipitation SAP table

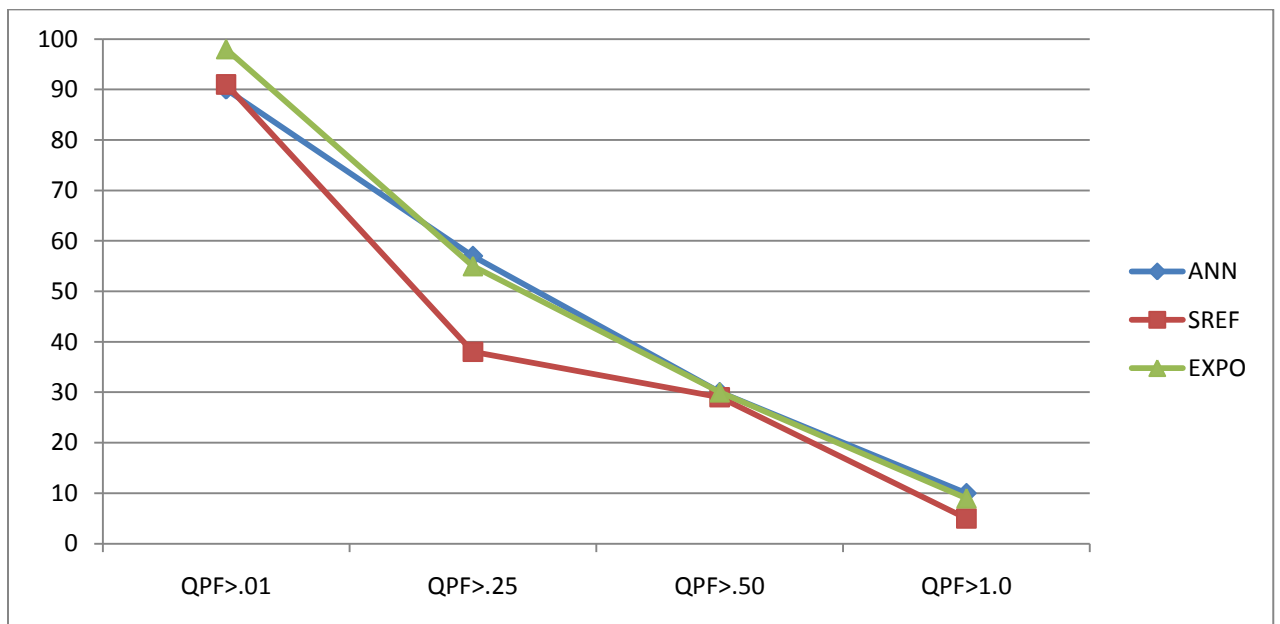


Figure 4. Future Probability of Exceedance Chart.